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(54) Vending machine for video cassette

(57) A machine for renting articles, e.g. video cassettes, and which is operated by a user having a card. The machine has control means (61) connected by a memory (62) which stores a code identifying each article against a code identifying the card used to rent the article. The control means (61) is so arranged that the user must use the same card to return an article as he used to rent it. The machine is enabled by a credit card at reader (16), which card is purchased at coin input (18); printer (21) provides a record of transactions. Keypad (17) is used to select a cassette for rental; memory (62) records via sensing means (55/56) the codes of empty compartments, the code of each cassette against the code of the compartment in which it resides from time to time, and the code of the user against that of the cassette rented.

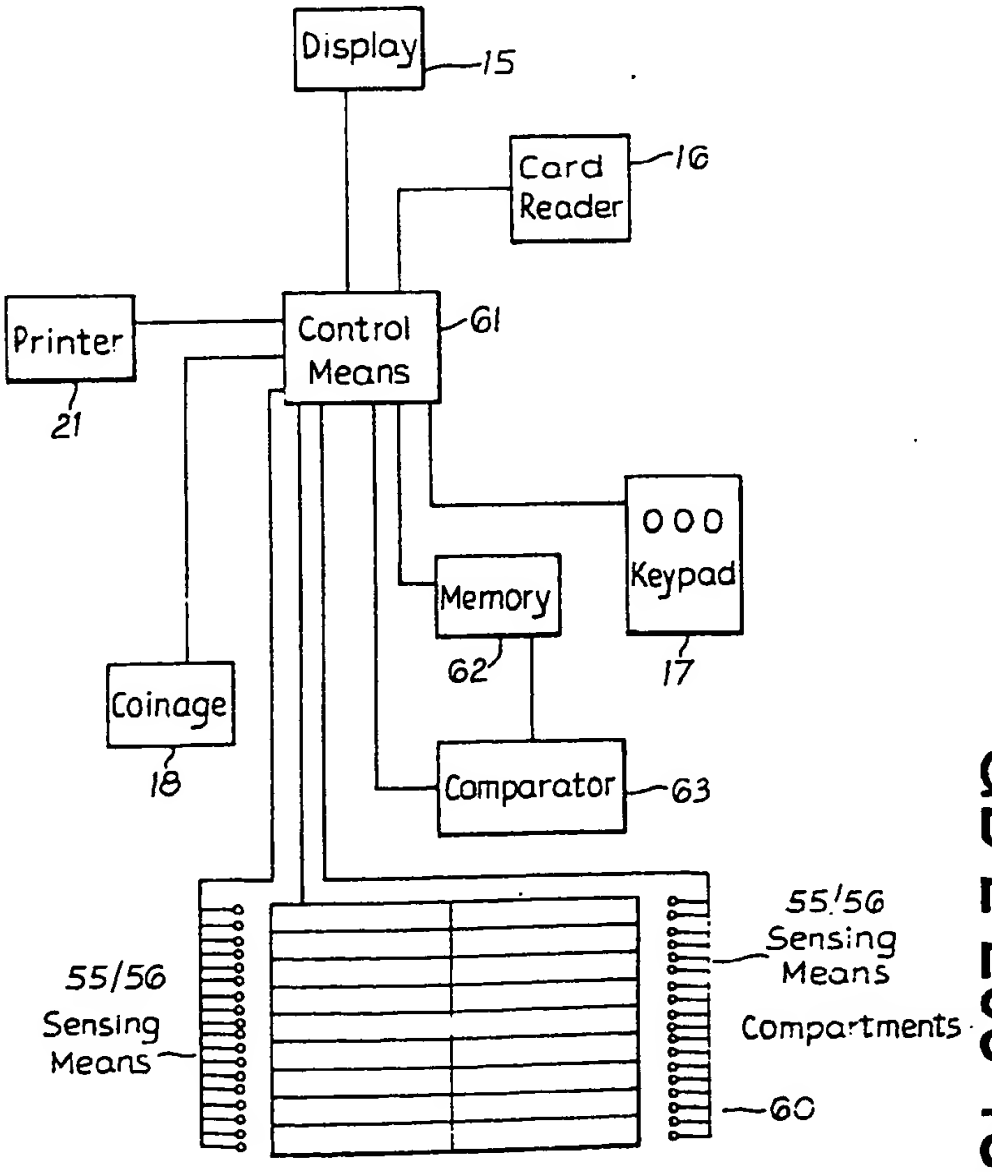

Fig. 3

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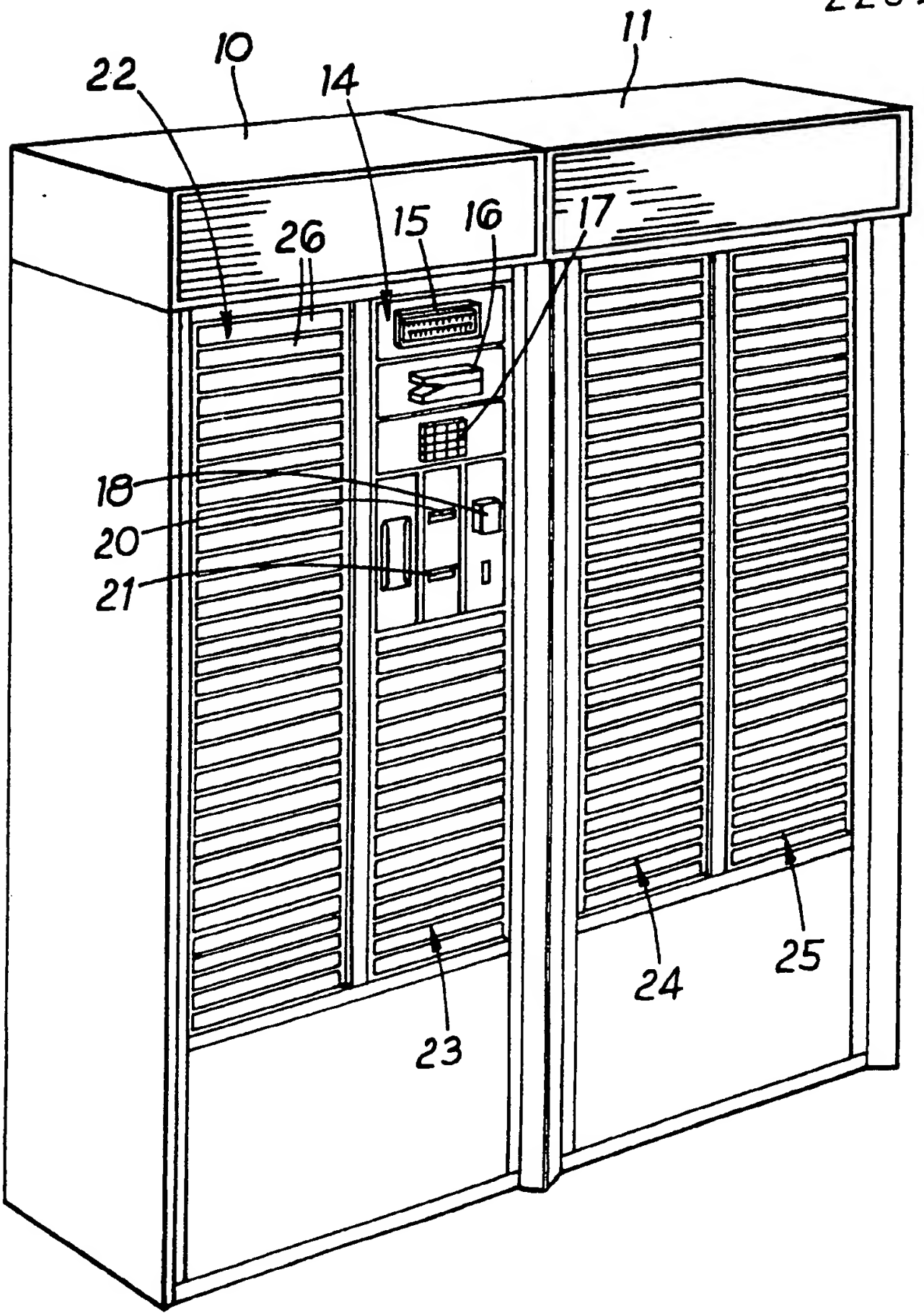

Fig. 1

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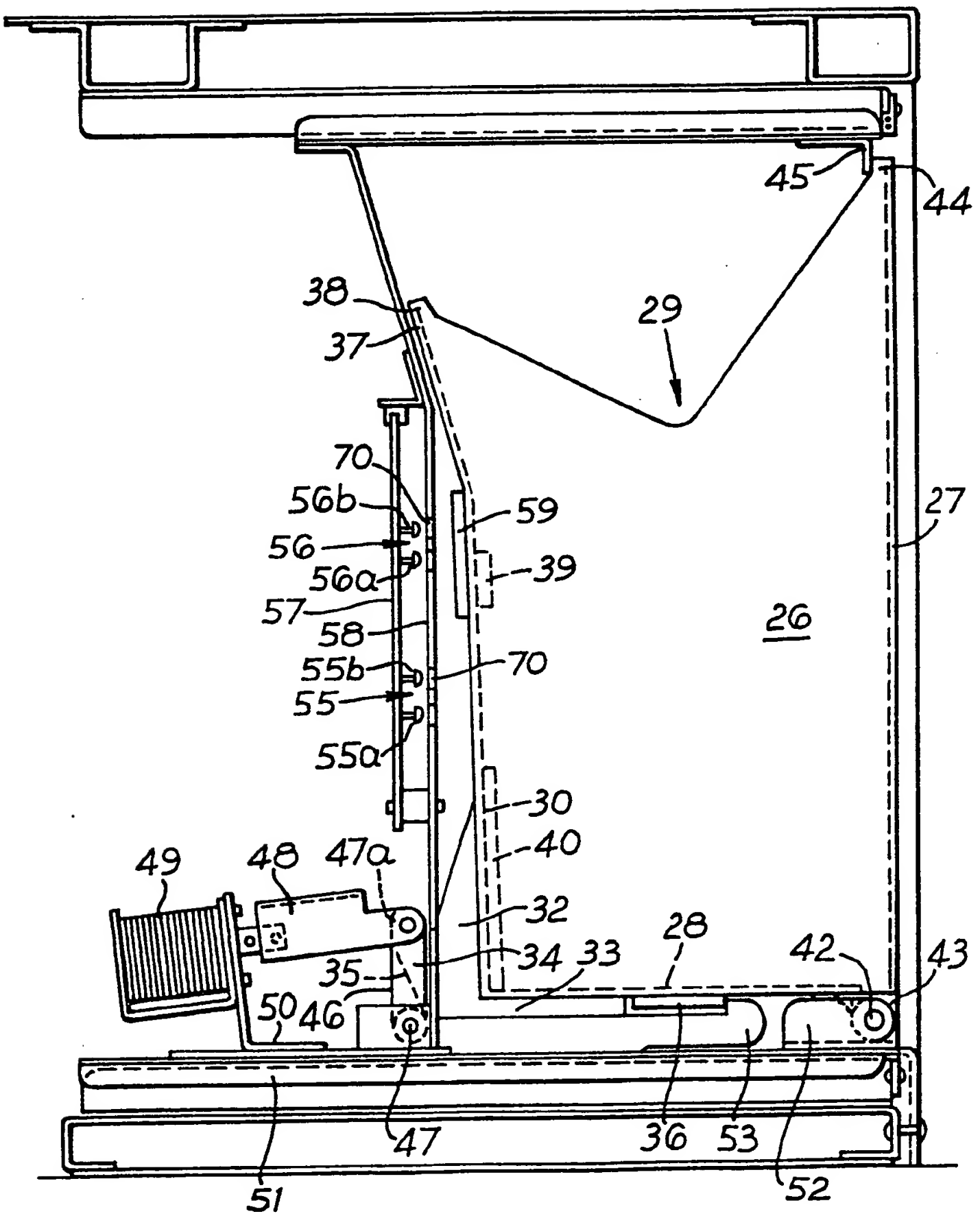

Fig. 2

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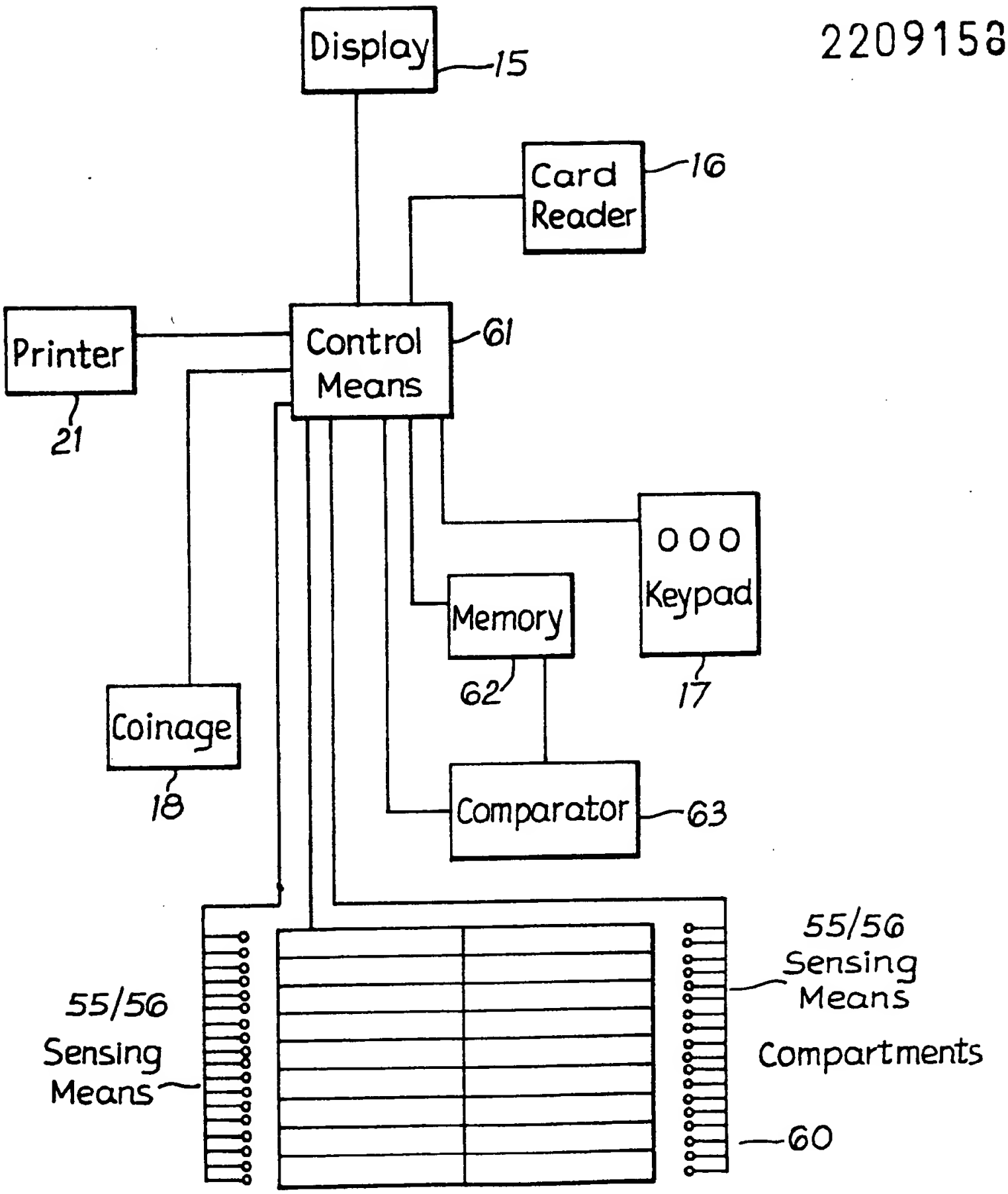

Fig. 3

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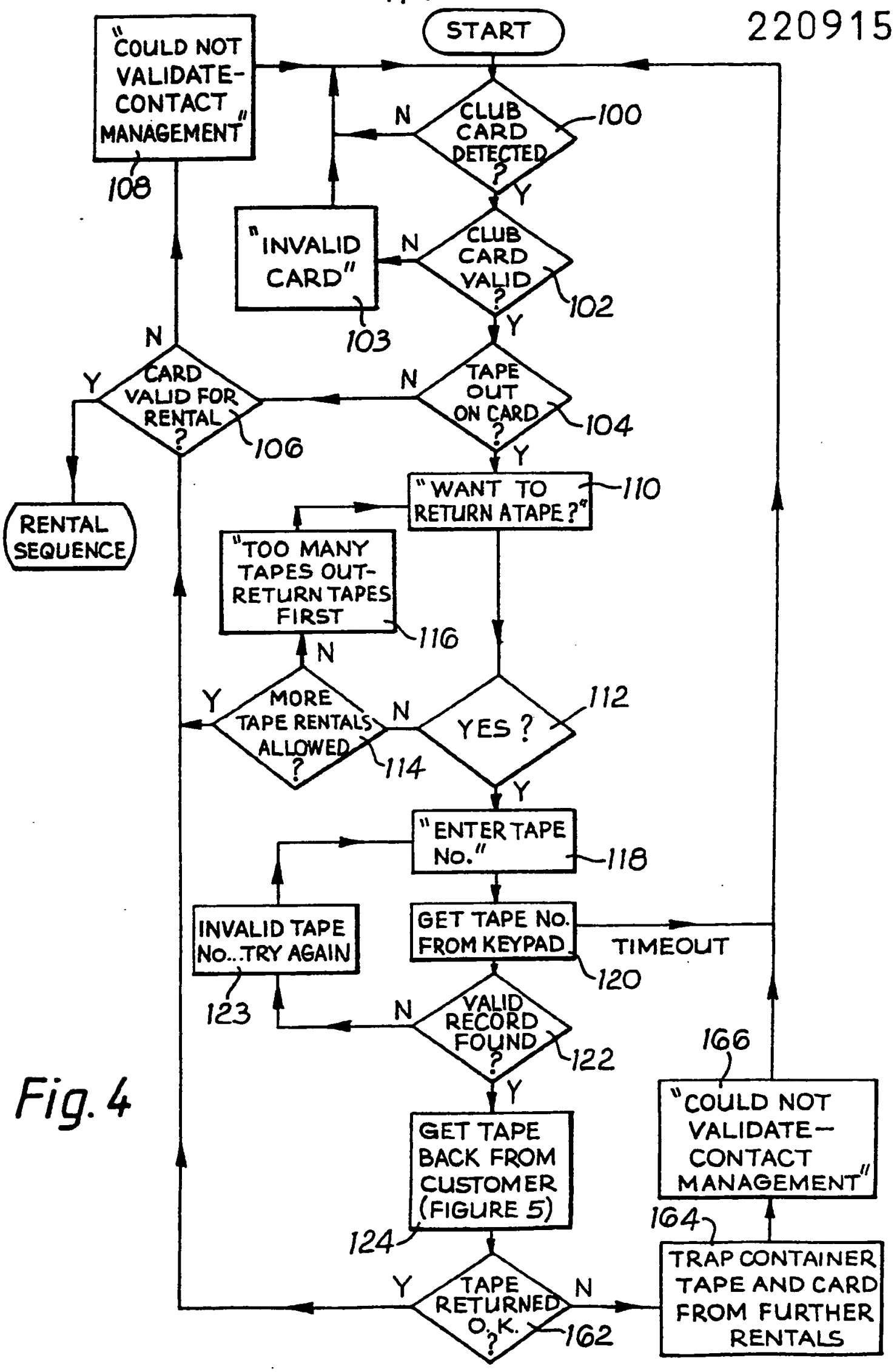

Fig. 4

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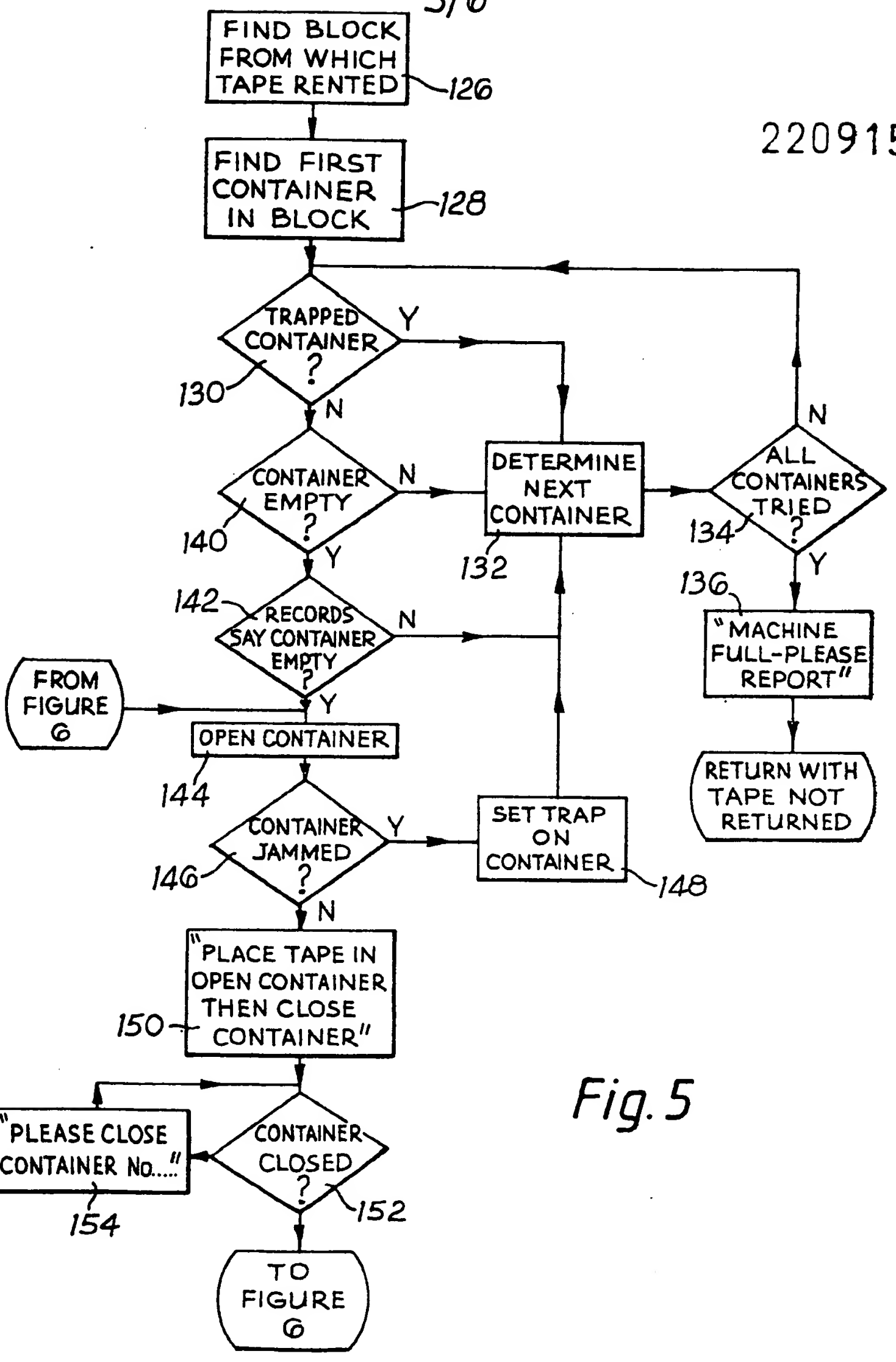

Fig. 5

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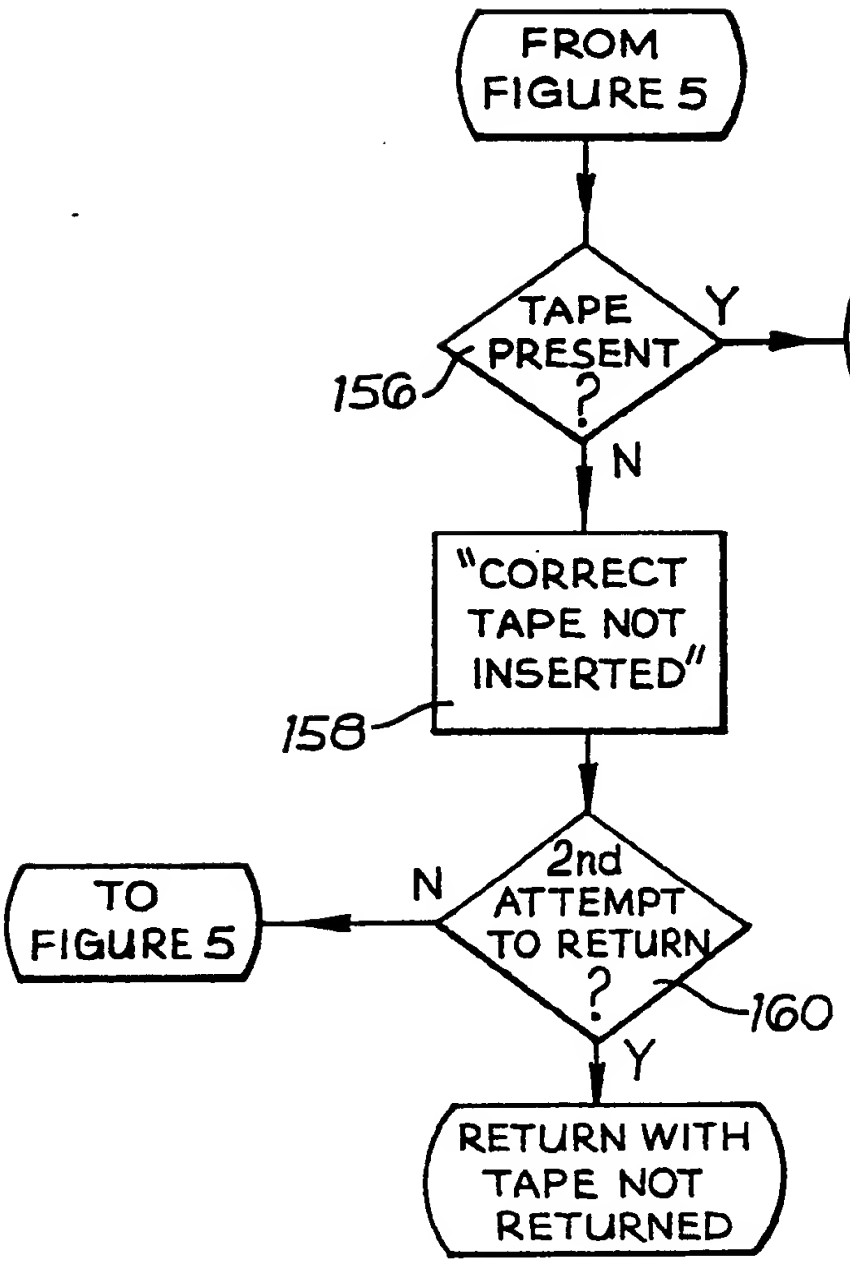

Fig. 6

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VENDING MACHINE

This invention relates to vending machines. The term "vending machine" in the present application is intended to cover machines arranged to rent a re-usable article, such as a video tape cassette, and accept its return. Additionally such a machine may be arranged to vend such articles.

In our International Application No. PCT/GB88/00283 we have described a vending machine in which a user credit is held in a memory in the machine as distinct from being held on a card used to operate the machine.

A problem which may arise with a machine of this type is that a user may use one card to rent an article, e.g. a video tape cassette and may seek to return the cassette by using another card belonging to himself or to a third party. The second card, being a valid one, will enable the machine to be operated but since the credit in the machine memory is held against the code of the first card which was used to rent the cassette, even though the user can use the second card and return the cassette, the machine will not register the return against the credit of the first card. This will produce accounting problems.

Even where a card is used which itself holds the credit memory, if a user uses two different cards to rent and return this will also cause difficulties.

The object of the invention, therefore, is to provide a vending machine so arranged that, if a card is

used, the same card must be used to return the article as was used to rent it. If a validating system other than a card is used then again the validating system used to return the article must be the same validating system as was used to rent the article.

According to the invention, therefore, we provide a vending machine for renting re-usable articles, e.g. video tape cassettes, and comprising means for validating a coded user input to allow a user to operate the machine; a plurality of containers each adapted for receiving an article and each having a closed state in which an article in the container is not available to a machine user and an open state in which an article can be removed from or replaced in the container by the user, each container having an identifying code and each article having an identifying code; control means having a rental mode and a return mode; user-operable input means to input a code; the control means being capable of being activated by the user when the control means is in rental mode to open a selected container and being capable of being activated by the inputting of an article code via the input means when the control means is in return mode to open an empty container to receive the article; and a memory associated with the control means and which holds (1) the code of each article in the machine against the code of the container in which the article is held from time to time, the memory being updated every time an article is rented and returned, and (2) the code of each article which has been rented against the coded user input of the user who rented the article; the control means being arranged to open an empty container when a valid article code is inputted via the input means in the return mode of the control means provided that the coded user input used to return the

article is that held in the memory against the inputted article code.

Since the memory holds the code of each article which has been rented against the coded user input of the user who rented the article, normally the identification number on the user's card, only if that card is used to return the article will the machine open a container and allow the article to be returned. This arrangement therefore overcomes the problem that two cards could be used to rent and return an article.

As has been described, the means of validating a coded user input may include a card reader capable of reading a user identification held by a card read thereby.

Each article may carry a numeric code and the machine may include a key pad to enable a user to input an article or container code.

Other features of the invention will be clear from the following description and claims.

An embodiment of the invention will now be described in detail and by way of example with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a vending machine embodying apparatus of the invention;

Figure 2 is a section through one of the containers shown in Figure 1;

Figure 3 is a schematic block diagram of the vending machine; and

Figures 4 to 6 are simplified flow charts of the operation of control means of the machine, Figure 6 being a continuation of Figure 5.

Referring now to Figure 1, the vending machine there shown comprises a master unit 10 and a slave unit 11 which are connected together and are supported if desired by a connection, not shown, to an adjacent wall.

The master unit contains a control panel 14 which in turn contains a display 15, a wipe-through card reader 16, a key pad 17, a coinage receiver 18, a card dispenser 20 for dispensing a club card and a printer outlet 21.

Video tape cassettes are received in columns of containers, there being four such columns of containers indicated generally at 22, 23, 24 and 25. The columns 22 and 23 are in the master unit and the columns 24 and 25 are in the slave unit. The columns are made up of modules of eight containers, each of the columns having four such modules except column 23 which has only two. The control and operation of all the containers is from the control panel 14. Additional slave units having additional columns of containers may be added to the right-hand end of the assembly and controlled from the control panel 14.

Figure 2 is a horizontal section through one of the columns 22 to 25 and shows a container 26.

The container 26 is moulded from a high strength transparent plastic material and is in the form of a

pocket of generally rectangular cross section. Thus the pocket has a transparent front face 27, a closed end 28 and an open end 29. The container has a transparent back face 30. A projection 32 in the form of a rib extends rearwardly from the back face 30 and is continued at 33 along the closed end 28. The rib has an abutment 34 and an inclined surface 35. The rib extension 33 on the closed end terminates in a pocket 36. It will be seen that the open end 29 of the container is cut away so that an article received therein may be grasped when the container is open, as will be described, and that the rear face 30 diverges at its upper end, in Figure 2, as indicated at 37 ending in an abutment 38.

The rear face 30 is formed on its internal surface with pairs of ribs 39 and 40 on either side of the aperture 31 and these ribs provide a groove between them for locating a sleeve containing a tape cassette as described in International Application PCT/GB87/00197 to which reference should be made.

The container 26 is pivoted about an axis which in use is vertical and is indicated at 42, the container being provided with an apertured lug 43 for that purpose. The container in Figure 2 is shown in a closed state and has an abutment 44 which engages a fixed abutment 45 on the supporting structure of the unit.

The container is held in a closed position by a latch comprising a pair of links 46 which are pivoted at 47 to the supporting structure and, at their upper ends in Figure 2, are connected by a pin 47a which has a roller (not shown) mounted thereon which engages the abutment 34. Also secured to the pin 47a is a link 48 which in turn is connected to a solenoid 49. The link 48

is spring urged to the right in Figure 2 so that the parts normally occupy the positions shown in that Figure. The solenoid is mounted at 50 on the supporting structure 51 which also carries a support 52 for the pivot axis 42.

A U-shaped spring 53 has one end received in the pocket 36 and the other end engages the structure 51. The arrangement is such that if the solenoid 49 is energised it pivots the links 46 in an anti-clockwise direction in Figure 2, the roller on the pin 47a comes out of engagement with the abutment 34 and the container is moved by the spring 53 to an open position in which the abutment 38 is midway between the position shown in Figure 2 and the abutment 45. The customer may then open the container against the spring 53 until the abutment 38 engages the abutment 45. Release of the container results in the spring returning it to its midway position and then it may be closed by the customer. In the fully open position an article in the container can be removed or replaced.

The container is shut manually and as it is moved to its closed position the surface 35 engages the roller on the pin 47a and retracts the link 48 until the container reaches its fully closed position whereupon the link 48 moves to the right in Figure 2 and the roller on the pin 47a again engages the abutment 34 to hold the container in a closed position.

Associated with each container 26 there are two sensing means, namely 55 and 56. Each sensing means comprises an electro optical emitter 55a and 56a and an electro optical sensor 55b and 56b. The sensing means 55 and 56 are mounted on a printed circuit board 57 which runs the whole length of a module of eight containers 26

and carries all the emitters and sensors and asociated circuitry for the containers 26 in that module. In front of the printed circuit board 57 is a back plate or screen 58 positioned between each container 26 and its associated opto-electronic sensors 55b and 56b and opto-electronic emitters 55a and 56a. The screen 58 has apertures 70 therein arranged to allow radiation to pass from each emitter 55a and 56a to the container 26 and from the container 26 to the sensors 55b and 56b. The sensing means 55 may be used to sense whether there is a cassette in the container 26 when it is in a closed state and the sensing means 56 may be used to sense whether or not the container 26 is in its closed state.

The emitters 55a and 56a are arranged to emit light radiation and are provided by light-emitting diodes. The sensors 55b and 56b are arranged to detect light levels above a given threshold and are provided by photo-electric cells. However, any other suitable form of radition emitters and sensors may be used, e.g. emitters and sensors operable in the infra-red band of the spectrum. The angles at which the emitters 55a and 56a and the sensors 55b and 56b are mounted on the printed circuit board 57 are adjustable and are adjusted when the printed circuit board 57 is installed to ensure that the radiation emitted by each emitter follows the intended path and is received by the associated sensor.

Thus referring first to the sensing means 56, the container is provided, at a position opposite to the sensing means, with a reflective label 59. The arrangement is such that when the container is in its closed position as shown in Figure 2, if radiation is emitted from the emitter 56a of the sensing means 56 it will be reflected from the label 59 and will result in a

signal being generated by the sensor 56b of the sensing means 56. If, however, the container 26 is in its open position there will be insufficient reflection from the label to cause a signal to be generated in the sensor of the sensing means 56.

If the emitter is pulsed regularly at short time intervals it is thus possible to ascertain at said short time intervals whether the container 26 is in its open or closed position depending on whether or not signals are generated in the sensor 56b of the sensing means 56 by radiation emitted from the emitter of the sensing means.

In one possible embodiment, a tube which continually flashes (not shown), for example a xenon tube, can be used to provide emitters for a number of containers by transmitting, through optical fibres, the flashes from the xenon tube to an appropriate position on the printed circuit board 57 to cooperate with a sensor mounted thereon. Thus one would have a bunch of fibres receiving flashes from the tube continually and passing down the optical fibres to the free ends thereof, each free end providing an emitter associated with a container. The tube may emit ultra-violet radiation which causes a phosphorescent element to emit light which can be sensed after the emitter has ceased emitting.

As described in the above mentioned PCT application, it is intended that the cassette will fit into a sleeve which in turn fits into the container 26, the sleeve having a rib to engage between the ribs of the pairs of ribs 39 and 40 so as to ensure that the sleeve is inserted in the correct position. The sleeve is made of a transparent plastic material.

The cassette is also provided with a label (not shown) similar to the label 59 and it is arranged that when the cassette within its sleeve is properly located in the container 26 radiation from the emitter 55a of the sensing means 55 will be reflected by the label to produce a signal in the sensor 55b of the sensing means thus enabling the latter to be used, when the container is in its closed state, to sense whether there is a cassette in the container which bears an appropriate reflective label.

Preferably the label 59 and the label on the cassette are tamper-proof labels. That is to say that they cannot be removed from the container and the cassette respectively without destroying their reflective properties which would thus prevent the sensors operating correctly. Thus if somebody tried to remove the reflective label from a cassette which he had had from the machine and put it on another item of the same size this would be impossible and, as described below, if, upon a cassette being returned, the sensing means 55 does not sense an appropriate reflective label the cassette will be rejected or, if repeated efforts are made to return it, it will be accepted but the container will be disabled and the user will be prevented from carrying out any further transactions until the machine has been reset.

The reflective label on the cassette is "visible" to the sensor of the sensing means 55 through the transparent back wall 30 of the container and through the transparent sleeve in which the cassette is received within the container.

If, after a container has been opened, it is not shut by the user of the machine, this will be sensed by the sensing means 56 which will disable the machine until the container has been shut.

The machine is designed to dispense video tape cassettes and it is important to the operation of the machine when used with such cassettes, that the name on the cassette can be read through the transparent front face 27 of the container. It is therefore important that the cassette be placed in the container in an appropriate position. This is facilitated by the provision of the sensing means 55 since for the reflective label to cause generation of a signal in the sensor of the sensing means 55 the label must face the sensing means and the label will be arranged so that when this happens the title of the cassette can be read through the front wall 27 of the container 26.

Referring now to Figure 3, one of the groups of containers in the machine is indicated in this figure at 60 and is controlled by control means in the form of a microprocessor indicated schematically at 61. The control means is connected to the display 15, the card reader 16, the key pad 17 and the coinage mechanism 18 which are all of conventional construction.

The printer 21 is connected to the control means 61 as is a memory 62. A comparator 63 is connected to the control means 61 and the memory 62.

Preferably, the machine is arranged to be operated by a club card. Thus a user may purchase a club card for a given sum and this will entitle him to a certain number

of rentals or he may be allowed a number of rentals on credit.

The sequence of operation of the machine is, referring to Figures 4, 5 and 6, as follows.

Figure 4 shows the sequence carried out by the control means 61. At step 100, a club card is detected or, if not, the sequence returns to the start. Once a card has been detected by a user passing it through the reader 16 and the coded user identification on the card read, the control means 61 in step 102 interrogates the memory 62 to ascertain whether the code number read from the card is identical to the code number of a card issued for the machine. This and other comparisons referred to below are made using the comparator 63 to compare the contents of the memory 62 with the data received by the control means 61. If so, the card is regarded as valid. If not, the control means 61 causes the display 15 to display "Invalid Card" at step 103 and returns to the start of the sequence. Normally a club card will only be useable on one machine unless the machines are inter-linked. The first time a particular club card is used it will establish a credit stored in the memory 62.

If the card detected is valid, the control means 61 interrogates the memory 62, in step 104, to ascertain whether the card has been used to rent a tape which has not yet been returned. If not, the control means 61 interrogates the memory 62 to ascertain whether the card is valid for a further rental (step 106). This involves checking the credit level associated with the card to ascertain whether sufficient credit remains to rent a tape. If so, the control means 61 enters the rental mode thereof. If not, the control means 61 causes, at step

108, the display 15 to display "Could not validate, contact management" and returns to the start of the sequence.

If the card is found in step 104 to have been used to rent a tape which has not yet been returned, the control means 61 enters its return mode and causes, in step 110, the display 15 to display "Want to return a tape?" and awaits a response from the keypad 17 at step 112. If the response is "No", the control means 61 proceeds to step 114 where it interrogates the memory 62 to ascertain whether any further rentals are allowed. This involves the situation in which two or more simultaneous rentals are allowed on one card and ascertaining whether the maximum permitted number of simultaneous rentals has already been reached for the present card. If no more rentals are permitted before return of a tape, the control means 61 proceeds to step 116 at which the display 15 is caused to display "Too many tapes out - Return tapes first". The control means 61 then returns to step 110.

If the response from the keypad 17 at step 112 is "Yes", the control means 61 proceeds to step 118 at which it causes the display 15 to display "Enter tape No." and at step 120 awaits a response from the keypad 17. If no response is received from the keypad 17 in a predetermined time, the control means returns to the start of the sequence. If a response is received from the keypad 17 within the predetermined time, the control means 61 proceeds to step 122 at which it interrogates the memory 62 to ascertain whether the response received from the keypad 17 represents a valid tape number. In the memory 62, the number of each tape which has been rented and not yet returned is stored against the number

of the card used to rent it. At step 122, the number entered via the keypad 17 is compared with the list of tapes out on rental. If a corresponding number is not found, the control means 61 proceeds to step 123. If, however, a corresponding number is found, the card number used to rent that tape is compared with the card number read at step 100. If the card numbers are not identical, the control means 61 proceeds to step 123 but, if they are identical, proceeds to step 124. At step 123, the display 15 is caused to display "Invalid tape No. - try again" and after a predetermined time returns to step 118. If the tape number is valid, the control means 61 proceeds from step 122 to step 124 which represents the tape return sequence shown in Figure 5.

The tape return sequence begins at step 126 where the control means 61 interrogates the memory 62 to ascertain which block of eight containers 26 contains the container 26 from which the tape was rented. The control means 61 then proceeds at step 128 to investigate the first container 26 in the block identified at step 126. Firstly, at step 130, the control means 61 investigates whether the container 26 is trapped, i.e. whether a fault or irregularity associated with this container has previously been detected causing a trap to be entered in the memory 62 against this container. If the container 26 is detected as trapped, the control means 61 proceeds to step 132 where it determines the number of the next container in the block or the next block if it has reached the end of a block. The control means 61 then proceeds to step 134 where it determines whether it has applied steps 130 and 132 to all the containers 26 in the machine. This is done by comparing the number determined as a result of the step 132 with the number determined as a result of step 128. If steps 130 and 132 have been

applied to all the containers 26 in the machine, the control means 61 causes at step 136, the display 15 to display "Machine full - please report" and then proceeds to step 162 (to be described) with the message "tape not returned". If, at step 134, it is found that all containers 26 have not yet been tried, the control means 61 returns to step 130.

If, at step 130, it is ascertained that the container 26 is not trapped, the control means 61 proceeds to step 140 where it operates the sensing means 55 associated with the container 26 under consideration to determine whether the container contains a cassette. If the container 26 is found to contain a cassette, the control means 61 proceeds to step 132. If, however, the sensing means 55 fails to detect a cassette indicating that the container 26 is empty, the control means 61 proceeds to step 142. At step 142, the control means 61 interrogates the memory 62 to ascertain whether the container 26 under consideration is empty according to the record of previous transactions stored in the memory. If the container is not ascertained to be empty, the control means 61 proceeds to step 132 and, if it is ascertained to be empty, the control means 61 proceeds to step 144 in which it causes the solenoid 49 of the container 26 under consideration to operate to open the container.

The control means 61 then proceeds to step 146 at which it operates the sensing means 56 associated with the container under consideration to determine whether the container has in fact opened. If the container 26 is detected as still closed by the sensing means 55, the control means 61 causes, at step 148, a trap to be entered into the memory 62 with reference to the

container under consideration (such a trap might be used in step 130 aforementioned) and proceeds to step 132. If, however, the sensing means 55 at step 146, senses that the container 26 has opened, the control means 61 proceeds to step 150 at which it causes the display 15 to display "Place tape in open container - then close container" and proceeds to step 152.

At step 152 after a predetermined time, the control means 61 causes the sensing means 56 to operate to sense whether the container has been closed. If not, the control means proceeds to step 154 at which it causes the display 15 to display "Please close Container No....." and the number of the container 26 under consideration, and then returns to step 152. If the sensing means 56 detects that the container 26 has been closed at step 152, the control means 61 proceeds to step 156 (Figure 6).

At step 156, the control means 61 operates the sensing means 55 to determine whether there is a tape in the container 26 which has just been closed. If the sensing means 55 does not sense that there is a tape in the container, the control means proceeds to step 158 at which it causes the display 15 to display "Correct tape not inserted". It then proceeds to step 160 at which it checks whether this is the second attempt to return the tape. If it is not the second attempt, the control means returns to step 144 but, if it is the second attempt, it proceeds to step 162 (Figure 4) with the message "tape not returned". If, however, the sensing means 55 determines at step 156 that a tape is in the container, the control means proceeds to step 162 with the message "Tape returned O.K.".

At step 162 (Figure 4), the control means 61 checks whether the aforementioned message indicates that the tape has been returned, if not the control means proceeds successively to steps 164 and 166 and then proceeds to the start of the sequence. At the step 164, the control means causes a trap to be entered in the memory 62 in respect of the container under consideration, the tape number under consideration and the card in use. This will cause step 102 to result in the card not being ascertained as valid if it is re-entered into the machine, step 122 determining the tape number as invalid, and step 130 regarding the container as trapped. Step 166 causes the display 15 to display "Could not validate, contact management".

If, at step 162, the message indicates that a tape has been returned, the control means 61 proceeds to step 106 at which it checks card validity before either entering the rental mode or returning to the start via step 108.

If the control means 61 enters the rental mode from step 106, the control means will ask the user which tape he wishes to rent. The user then uses the keypad 17 to enter the number of the container 26 containing the tape concerned and the control means after checking that the container contains a tape and is not trapped will cause the display 15 to display how much the cassette rental costs and ask if this is acceptable. If the user replies "Yes" by appropriate operation of the key pad 17 then the control means will operate to open the appropriate container from which the user will take the cassette. After the user has taken the cassette he should close the container. The sensing means 56 will sense whether or not the container has been closed. If it has not the

control means will produce an audible signal and the machine will be disabled until the container is closed.

The control means 61 and the memory 62 will operate so as to decrease in the memory the user credit held by that user by the amount of the rental charge for the cassette.

The memory will also record (1) the code of each cassette in the machine against the code of the container in which the cassette is held from time to time, the memory being updated every time a cassette is rented or returned, (2) the code of each cassette which has been rented against the user's identification code, and (3) the identity of the block of containers which contains the container from which the cassette was rented.

If the machine is fitted with a printer 21 as indicated then the printer will print out a receipt showing the amount which the user has been debited.

The fact that the machine ensures that a cassette cannot be returned by a user using a card other than the one which he used to rent the cassette with ensures that the proper rental charge will be debited against the user's card for the period of rental.

It will be appreciated that if it were possible for the user to use a different card to gain access to the machine to return the cassette then, so far as the machine is concerned, the cassette would never have been returned and the credit of the initially used card would be decreased by, for example, the cost of the cassette.

When the user closes the container at the end of the return sequence, the latch comprising the solenoid 49 and the links 46 and 48 will hold the container in its closed position as described above. In this position, if the cassette has been properly inserted into the container and if the cassette carries an appropriate reflective label, this will be sensed by the sensing means 55 and the signal generated by the sensor of the sensing means will allow the transaction to be completed and the container will remain latched in its closed state.

It is envisaged that the machine will be inspected at regular intervals by a supervisor who will ascertain what has occurred. From what is held in the memory, which may be down-loaded into a data base, the supervisor will be able to see which user it was who returned the incorrect article or returned it the wrong way and if necessary the account of that user can be debited with the total cost of the cassette which he rented if he has returned any correct cassette or some other article. If the user had returned the correct cassette but the wrong way round then the supervisor will place the cassette in the machine the correct way round and reset it so that the user may again use the machine.

The arrangement has been described as being one in which the container is disabled only after the user has made two unsuccessful attempts to complete the transaction. This disablement could take place after any desired number of attempts to close the container with the cassette in the wrong way round or with a foreign article in the container.

A feature of the machine is that it is possible periodically to scan all the sensing means 55, 56 of all

the containers. Thus a scan will show which containers are in their open state and which in their closed state and will also show which containers contain cassettes.

Means may therefore be provided to scan the sensors periodically and to compare the result of the scan with the transactions, i.e. rentals and returns, which are held in the memory 62.

If as a result of successive comparisons carried out by the comparator 63, it is found that containers apparently move from their closed state to their open state and/or cassettes are removed from containers without there being any corresponding transactions held in the memory appropriate action can be taken.

The changes may be due to component failure or may be due to vandalisation of the machine, i.e. somebody forcing open the containers and removing the cassettes.

Any desired routine of remedial action can be set in the control means. One such routine may be firstly to disable a container which has changed its state without there being any transaction affecting it on the supposition that there has been some component failure. The routine may similarly disable a second container which has changed its state. If a third container, however, changes its state without there being any transaction the routine could be such as to sound an alarm or, if the machine is connected to a remote terminal by way of a modem to dial up and give warning because it is likely that the machine is being vandalised.

We have described the use of reflective labels as the identifying elements of the articles and containers. However, labels which phosphoresce or otherwise are sensitized by an emitter could be used.

Other opto-electronic emitters and sensors may be used than those specifically described.

It will be seen that by the use of opto-electronic sensors and emitters one can provide a machine in which the sensing means provided by these are protected from defrauders as for example by the back plate 58 in the particular embodiment described and there are merely apertures in the back plate though which emitters and sensors emit and receive radiations.

CLAIMS

1. A vending machine for renting re-usable articles, e.g. video tape cassettes, and comprising means for validating a coded user input to allow a user to operate the machine; a plurality of containers each adapted for receiving an article and each having a closed state in which an article in the container is not available to a machine user and an open state in which an article can be removed from or replaced in the container by the user, each container having an identifying code and each article having an identifying code; control means having a rental mode and a return mode; user-operable input means to input a code; the control means being capable of being activated by the user when the control means is in rental mode to open a selected container and being capable of being activated by the inputting of an article code via the input means when the control means is in return mode to open an empty container to receive the article; and a memory associated with the control means and which holds (1) the code of each article in the machine against the code of the container in which the article is held from time to time, the memory being updated every time an article is rented and returned, and (2) the code of each article which has been rented against the coded user input of the user who rented the article; the control means being arranged to open an empty container when a valid article code is inputted via the input means in the return mode of the control means provided that the coded user input used to return the article is that held in the memory against the inputted article code.

2. A machine according to Claim 1 wherein the means for validating a coded user input includes a card reader

capable of reading a user identification held by a card read thereby.

3. A machine according to Claim 1 or Claim 2 wherein each article carries a numeric code and the machine includes a key pad to enable a user to input an article or container code.

4. A machine according to any preceding claim wherein the memory also holds the identity of a block of containers which contains the container from which an article was rented, and the control means is arranged to select an empty container from this block to open if one is available.

5. A vending machine for re-usable articles having a memory arrangement substantially as hereinbefore described with reference to the accompanying drawings.

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